Food Insecurity and Obesity: A Comparison of Self-Reported and Measured Height and Weight

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Objectives. We used self-reported and measured height and weight data to examine the relationship between food insecurity and obesity.

Methods. We defined food insecurity according to 3 different models. We used self-reported and measured height and weight from 2 versions of the Canadian Community Health Survey to calculate obesity rates.

Results. When self-reported height and weight data were used in calculating obesity prevalence rates, rates were significantly higher among food-insecure respondents than among food-secure respondents; by contrast, when measured height and weight data were used, there were no significant differences. Female respondents classified as food insecure and experiencing mild hunger were at greater risk of obesity than were food-secure female respondents when measured height and weight were used.

Conclusions. Associations between obesity and food insecurity are more pronounced when self-reported data on height and weight are used than when measured height and weight data are used. Caution should be used when using self-reported data to examine the relationship between food insecurity and obesity. (*Am J Public Health.* 2007;97:751–757. doi:10.2105/AJPH.2006.093211)

Food security is recognized as an important determinant of health,[1,2] and both food insecurity and obesity are emerging public health concerns. The relationships among inadequate nutrient intake, poor health, and food insecurity are well established in the literature.[3–19] However, an evolving body of research investigating the association between body mass index (BMI; weight in kilograms divided by height in meters squared)—obesity in particular—and food insecurity has revealed contradictory findings in Canada, the United States, and other countries.[2,8,12,20–22]

For example, an analysis of 1998–1999 Canadian National Population Health Survey data revealed that residents of food-insecure households were 1.5 times more likely than residents of food-secure households to be obese (i.e., BMI ≥30 kg/m^2) when age, gender, and income were taken into account.[3] By contrast, in a later examination of food insufficiency, Vozoris and Tarasuk,[17] using data from the 1996–1997 version of the same Canadian survey, found no significant association between household food insufficiency and BMI among female respondents and significantly decreased odds of overweight (i.e., BMI of 25.0–29.9) among male respondents after they controlled for age, education, and income adequacy.

Similarly conflicting findings have been uncovered in US studies. For instance, research involving a representative sample of US households revealed that, among female respondents, food insecurity was positively associated with being overweight.[16] This finding was supported by another US study showing that women in food-insufficient households were more likely than women in food-sufficient households to be overweight and to consume poor diets.[21] Conversely, in a study of adults residing in 2 US states, Laraia et al. concluded that there was no association between overweight and obesity with concerns about food sufficiency after they controlled for education, income, race/ethnicity, marital status, and general health.[22]

Further contradictory findings from an analysis of the Third National Health and Nutrition Examination Survey demonstrated that younger girls (aged 2 to 7 years) from all racial/ethnic groups who lived in food-insufficient households were at lower risk of being overweight than were younger girls who lived in food-sufficient households, whereas the opposite pattern was found among older (aged 8 to 16 years) non-Hispanic White girls.[15] It is clear from the discrepancies just described that differences between studies in measurements of food insecurity and food insufficiency, definitions of overweight and obesity, and choices of confounding variables result in both confusion and complexity in terms of delineating the relationship between food insecurity and BMI.

The majority of previous research has relied on self-reported measures of height and weight to examine BMI and food insecurity.[3,14,15,20,22] To our knowledge, no research in Canada to date has employed national data on measured height and weight to examine the relationship between food insecurity and obesity. Recent trends show that rates of obesity are higher when measured data on height and weight are used in calculating obesity than when self-reported height and weight are used.[23] In addition, associations derived from most previous research involving self-reports (the Townsend et al.[16] study is an exception) do not account for underreporting of weight or overreporting of height.

Given the potential consequences of both food insecurity and obesity on individual health and related health care system costs, it is important to understand how obesity relates to food insecurity. Therefore, we sought to provide a unique look at the association between obesity and food security by assessing data on measured height and weight as well as comparative data on self-reported height and weight.

METHODS

Data Sources

Data were derived from the Canadian Community Health Survey (CCHS), cycle 1.1 (CCHS 1.1; 2000–2001) and cycle 2.2 (CCHS 2.2; 2004). CCHS 1.1 was a general health survey of 135 535 individuals aged 12 years or older who were living in private

households; residents of Indian reserves, Canadian Armed Forces bases, health care institutions, and some remote areas were excluded. The overall response rate was 85%. In this analysis, we excluded information from the 3 Canadian territories so that the data would be comparable with CCHS 2.2 data; as a result, the sample was reduced to 128 500 individuals.

CCHS 2.2, a survey involving 35 107 individuals of all ages, was specifically designed to gather information about the nutritional status of the Canadian population. It did not include residents of the 3 Canadian territories, Indian reserves, and some remote areas or regular members of the Canadian Armed Forces. The overall response rate was 77%. In an effort to ensure that the data were comparable with those of CCHS 1.1, we included only people aged 12 years or older with measured height and weight information, which reduced the total to 16 527 individuals. Table 1 presents weighted distributions of sample characteristics for CCHS 1.1 and CCHS 2.2.

TABLE 1—Selected Characteristics of Among Respondents Aged 12 Years or Older: CCHS 1.1, 2000–2001, and CCHS 2.2, 2004

	CCHS 1.1		CCHS 2.2	
	Sample Size	Estimated Population,[a] No, Thousands (%)	Sample Size	Estimated Population,[a] No, Thousands (%)
Total	128 500	25 635 (100.0)	16 527	26 500 (100.0)
Gender				
Male	59 364	12 619 (49.2)	7 300	13 181 (49.7)
Female	69 136	13 016 (50.8)	9 227	13 319 (50.3)
Age, y				
12–19	17 002	3 193 (12.5)	4 977	3 400 (12.8)
20–34	25 985	6 269 (24.5)	2 617	6 085 (23.0)
35–44	24 872	5 294 (20.7)	1 544	5 106 (19.3)
45–64	36 676	7 253 (28.3)	3 896	8 139 (30.7)
≥65	23 965	3 626 (14.1)	3 493	3 770 (14.2)
Household income category				
Low	5 470	881 (3.4)	626	735 (2.8)
Lower middle	11 772	1 760 (6.9)	1 308	1 534 (5.8)
Middle	28 243	5 111 (19.9)	3 598	5 116 (19.3)
Upper middle	40 474	8 145 (31.8)	5 236	8 694 (32.8)
High	28 626	7 039 (27.5)	3 987	8 009 (30.2)
Missing	13 915	2 699 (10.5)	1 772	2 412 (9.1)
Educational level				
Less than high school	43 124	7 463 (29.1)	7 283	6 901 (26.0)
High school	22 668	4 758 (18.6)	2 405	4 555 (17.2)
Some college	9 712	2 102 (8.2)	1 358	2 322 (8.8)
College or greater	51 785	11 102 (43.3)	5 393	12 468 (47.1)
Missing	1 211	211 (0.8)	88	254 (1.0)
Race/ethnicity				
White	116 597	21 832 (85.2)	14 676	21 924 (82.7)
Aboriginal	2 146	238 (0.9)	483	290 (1.1)
Black	970	423 (1.7)	146	450 (1.7)
Other	7 781	2 949 (11.5)	1 220	3 791 (14.3)
Missing	1 006	193 (0.8)	2	44 (0.2)
Marital status				
Previously married	24 023	3 105 (12.1)	3 017	3 293 (12.4)
Never married	37 133	7 630 (29.8)	6 064	7 866 (29.7)
Married	67 197	14 880 (58.0)	7 438	15 315 (57.8)
Missing	147	21 (0.1)	8	25 (0.1)
Area of residence				
Urban	94 690	20 959 (81.8)	12 546	21 624 (81.6)
Rural	33 810	4 676 (18.2)	3 981	4 876 (18.4)

Note. CCHS 1.1 = Canadian Community Health Survey, cycle 1.1; CCHS 2.2 = Canadian Community Health Survey, cycle 2.2. As a result of rounding, totals may not sum to 100%.
[a]Estimated household Canadian population aged 12 years or older (number of people represented by given sample after application of sample weights).

Measurement of Obesity

BMI was used in calculating obesity. In CCHS 1.1, self-reported height and weight data were collected from all survey respondents. In CCHS 2.2, height and weight measurements were conducted for 62% of survey respondents aged 12 years or older. With a special sample weight applied, the estimates for this group represented the Canadian population.

We used these data to calculate BMIs for all respondents aged 12 years or older, excluding pregnant respondents. A BMI cutoff of 30 kg/m^2 was used to classify adults (aged 18 years or older) as obese, in accord with the health risks associated with classification in this BMI category.[25] Because there is uncertainty regarding the BMI levels associated with health risks at younger ages, we used the age- and gender-specific cutoff points defined by Cole et al.[26] to classify obesity among youths aged 12 to 17 years. Midyear age points were assigned to all reported years of age (e.g., 15.5 for 15-year-olds).

Measurement of Food Insecurity

We formulated 3 different models of food insecurity in an effort to provide an enhanced understanding of the relationship between food insecurity and obesity when self-reported data on height and weight are used as well as when measured height and weight data are used.

Dimensional model of food insecurity. In CCHS 1.1, food insecurity was determined with 3 questions. Respondents were asked how often, in the past 12 months, they or anyone else in their household (1) were concerned that there would not be enough to eat because of a lack of money, (2) did not have enough food to eat because of a lack of

money, or (3) did not eat the quality or variety of foods that they wanted to eat because of a lack of money. Response options for the 3 questions were "often true," "sometimes true," and "never true."

The definition of food insecurity was subsequently refined via modification of the 3 questions just described.[3,4] We used this adaptation (relating to CCHS 1.1 only) to identify 3 dimensions of food insecurity for this study. Respondents who replied affirmatively (i.e., "often true" or "sometimes true") to the first question were considered to have food anxiety, and those who replied negatively (never true) were considered to have no food anxiety. Respondents who replied affirmatively to the second question were considered to be experiencing food poverty, and those who replied negatively were classified as not experiencing food poverty. Finally, respondents who replied affirmatively to the third question were considered to have compromised diets, whereas those who replied negatively were considered to not have compromised diets.

In CCHS 2.2, food insecurity was determined through a more elaborate probing process based on 18 questions that assessed overall household food security on a continuous linear scale referred to as the Food Security Module, adopted from the United States Department of Agriculture model of food security.[27] The first 3 questions of the Food Security Module were used to develop 3 dimensions of food insecurity comparable to those delineated in CCHS 1.1. Respondents were asked whether, in the past 12 months, (1) they or other household members worried that food would run out before they got money to buy more; (2) the food that they and other household members bought didn't last, and there wasn't any money to get more; and (3) they or other household members couldn't afford to eat balanced meals. Again, response options for the 3 questions were "often true," "sometimes true," and "never true."

We used the following parameters to define the 3 dimensions of food insecurity relating to CCHS 2.2: respondents who replied affirmatively (i.e., "often true" or "sometimes true") to the first question were considered to have food anxiety; respondents who replied affirmatively to the second question were considered to be in a state of food poverty; and respondents who replied affirmatively to the third question were considered to have compromised diets. Similar percentages of respondents answered affirmatively to at least 1 of the 3 questions in each of the 2 surveys: 14.6% in CCHS 1.1 and 12.1% in CCHS 2.2.

Levels model of food insecurity. Collectively, the 18 Food Security Module questions used in CCHS 2.2 represent a more sensitive measure of food insecurity than the dimensional model with its discrete categories. The Food Security Module includes questions that provide a unique look at how food decisions involving children relate to different degrees of food insecurity and more in-depth insights into the severity of food insecurity. The instrument can be used to determine household food security status through coding responses to each question. Here we coded responses such as "yes," "often true," and "almost every month" as 1 ("affirmative") and responses such as "no" and "never true" as 0 ("negative"). Resulting Food Security Module scale values ranged from 0 to 18 for households with children and from 0 to 10 for households without children. In our analysis, we classified Food Security Module scores into 4 household food security status groups, as follows.[27]

- *Food secure:* These households showed no or minimal evidence of food insecurity (Food Security Module score of 0–2).
- *Food insecure without hunger:* Food insecurity was evident in household members' concerns about the adequacy of their food supply and in adjustments to household food management, including reduced quality of food and increased atypical coping patterns. Little or no reduction in household members' food intake was reported (Food Security Module scores of 3–7 for households with children and 3–5 for households without children).
- *Food insecure with mild hunger:* Food intakes for adult household members were reduced to an extent implying that these individuals had repeatedly experienced the physical sensation of hunger. In most (but not all) food-insecure households with children, such reductions are not observed among children at this stage (Food Security Module scores of 8–12 for households with children and 6–8 for households without children).
- *Food insecure with severe hunger:* These households reduced children's food intake to an extent that the children experienced hunger. Adults in households both with and without children repeatedly experienced more-extensive reductions in food intakes (Food Security Module scores of 13–18 for households with children and 9–10 for households without children).

Overall food insecurity model. In CCHS 1.1, respondents who replied "often" or "sometimes" to at least 1 question were considered to have experienced food insecurity. Therefore, those who replied "never" to all 3 questions were categorized as food secure. In CCHS 2.2, respondents whose Food Security Module scores were greater than 2 were considered to reside in food-insecure households.

Sociodemographic Variables

Household income was defined according to total income from all sources in the 12-month period before the survey. Educational level was grouped into 4 categories: less than high school, high school, some post–high school education, and college degree. Marital status was classified as (1) single or never married; (2) divorced, separated, or widowed; or (3) married or in a common-law relationship.

Ethnicity was grouped into 4 categories (White, Aboriginal, Black, or other) on the basis of responses to a question on ethnic/racial origin. On the basis of Statistics Canada's geographical classifications for the 1996 census, area of residence was categorized as urban or rural. We defined urban areas as those with a minimum population of 1000 residents and a population density of 400 or more people per square kilometer. Areas that did not meet these criteria were classified as rural.

Data Analysis

We used weighted cross-tabulations to estimate obesity prevalence rates for all 3 models of food insecurity. Also, we conducted multivariate logistic regression analyses to determine the odds of being obese for individuals living in households characterized as food insecure. We controlled for confounding effects by including sociodemographic variables in

each regression model. To account for survey design effects, we estimated the variance used in calculating coefficients of variation (i.e., standard errors of estimates) and confidence intervals using the bootstrap technique.[28,29]

RESULTS

In comparisons involving the dimensional model of food insecurity, obesity prevalence rates were significantly higher among individuals living in households with any of the dimensions of food insecurity—food anxiety, compromised diets, or food poverty—than among the overall study population when self-reported height and weight data were used (Table 2). Conversely, rates were not different on any of these dimensions when measured height and weight data were used. In an attempt to gain a more sensitive perspective on relationships between obesity and severity of food insecurity according to measured height and weight, we conducted additional analyses using the levels model of food insecurity but were able to do so only for the CCHS 2.2 data. The results of these analyses showed a significant association between obesity and food insecurity with mild hunger.

Further gender-specific analyses using the overall food insecurity model classifications demonstrated that rates of obesity were significantly higher among respondents who were food insecure than among respondents who were food secure when self-reported height and weight data from CCHS 1.1 were used (Figure 1). However, when measured height and weight data from CCHS 2.2 were used to determine obesity, there were no significant differences in obesity according to food security status for either male or female respondents. These results are consistent with those shown in Table 2. The data in Figure 1 were based on the overall food insecurity model, and thus, food insecurity status reflected all 18 Food Security Module questions. In other words, the lack of association between food insecurity and obesity when measured data were used did not appear to be explained by the decision to use only 3 questions of the Food Security Module.

We further examined the association between obesity and overall food insecurity and dimensions and levels of food insecurity for both self-reported height and weight and measured height and weight while controlling for sociodemographic variables such as household income, education, ethnicity, marital status, and area of residence (Table 3). The overall association between food insecurity and obesity was significant for both male and female respondents in the case of self-reported but not measured data. No significant association between any dimension of food insecurity and obesity was evident among men when either self-reported or measured data were used.

Among female respondents, no specific dimension of food insecurity was associated with obesity when measured height and weight were used. However, in general, higher odds of obesity were found among female respondents when self-reported height and weight were used. Specifically, when self-reported data on height and weight were used, female respondents who had a compromised diet or were experiencing food poverty were more likely to be classified as obese.

When we used the levels model of food insecurity, we obtained quite different results for obesity among female respondents. Interestingly, when measured height and weight were used, female respondents living in households classified as food insecure with mild hunger were almost 3 times more likely to be obese than were female respondents living in food-secure households. Household food insecurity in the absence of hunger or severe hunger was not associated with obesity among female respondents.

TABLE 2—Obesity Prevalence Results, by Dimensional and Level Models of Food Insecurity and Overall, Among Respondents Aged 12 Years or Older: CCHS 1.1, 2000–2001, and CCHS 2.2, 2004

Food Insecurity Model	Obesity Rate, %	
	Self-Reported Height and Weight	Measured Height and Weight
Dimensional model		
Food anxiety	19.0***	22.5
Compromised diet	19.3***	23.6
Food poverty	20.1***	23.8
Levels model		
Food insecurity without hunger	. . .	19.3
Food insecurity with mild hunger	. . .	34.2*
Food insecurity with severe hunger	. . .	30.6[a]
Overall model	15.1	21.8

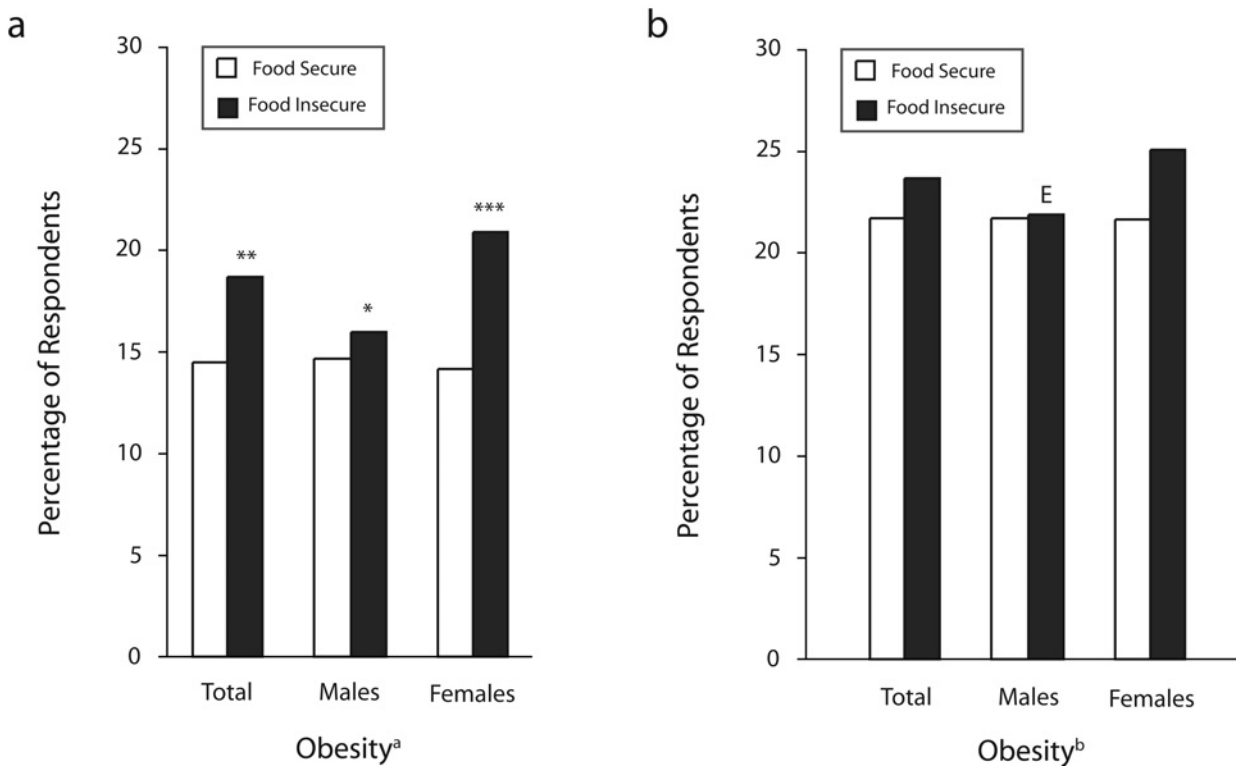
Note. CCHS 1.1 = Canadian Community Health Survey, cycle 1.1; CCHS 2.2 = Canadian Community Health Survey, cycle 2.2. See "Methods" section for information about how models were created.
[a]Coefficient of variation (standard error of the estimate) between 16.6% and 33.3%.
*$P < .05$; ***$P < .001$, for differences from total population.

DISCUSSION

The fact that CCHS 1.1 and CCHS 2.2 did not include homeless people or Aboriginal peoples living on Indian reserves may have been problematic, given that they tend to be at higher risk of food insecurity and obesity than other groups.[4,13,24] Furthermore, because analyses were based on cross-sectional data, no conclusions about cause-and-effect relationships can be made.

Previous research has shown that different instruments used to measure food insecurity can affect the relationship between food insecurity and obesity.[20,23] Although there may be some justification for caution because of the use of different instruments to measure food insecurity in CCHS 1.1 and CCHS 2.2, we attempted to compensate for this limitation through the use of 3 different models of food insecurity to add clarity and strength to our conclusions.

Our comparative analysis between self-reported height and weight data from CCHS 1.1 and measured height and weight data from CCHS 2.2 provides new and meaningful information on the association between obesity and food insecurity. When self-reported height and weight were used, prevalence rates of obesity were significantly higher among food-insecure male and female respondents than among food-secure male and female respondents; by contrast, when measured height and weight were used, there were no significant differences between the 2 groups.



Note. CCHS 1.1 = Canadian Community Health Survey, cycle 1.1; CCHS 2.2 = Canadian Community Health Survey, 2.2; E = coefficient of variation (standard error of the estimate) between 16.6% and 33.3%.
[a]From CCHS 1.1.
[b]From CCHS 2.2.
*P < .05; **P < .01; ***P < .001, for differences from food-secure households.

FIGURE 1—Obesity prevalence rates among respondents aged 12 years or older by self-reported height and weight (a) and measured height and weight (b): CCHS 1.1, 2000–2001, and CCHS 2.2, 2004.

Although the questions used to measure food insecurity in CCHS 1.1 and 2.2 were similar, differences in wording may have contributed to varied interpretations by participants, altering some of our results. However, when Rowland's equations[30] were used to adjust the self-reported data from CCHS 1.1 to allow estimates of measured data from CCHS 2.2, associations between obesity and food insecurity appeared to be generally consistent in the 2 surveys (data not shown).

Although the sample sizes for most of our models were sufficiently large, those for household insecurity with severe hunger in the food security levels model had a relatively small sample (n = 170). This may have resulted in a failure to achieve statistically significant findings that would have emerged had the sample been larger.

Previous research has shown that self-reported height and weight data are unreliable.[31] Moreover, studies have consistently shown that women underestimate their weight to a greater extent than do men and that discrepancies in self-reported weight are greater among overweight and obese individuals (again, more so for women).[30,31] For example, Bostrom and Diderichsen[31] found that when self-reported height and weight were used to determine BMI, overall, 81% of men and 78% of women were classified accurately, as compared with only 61% of obese men and 55% of obese women. This suggests that individuals, especially women, who are classified as obese according to measured height and weight may be classified as simply overweight or even as normal weight if self-reported height and weight are used. As a result of such discrepancies, the relationship between obesity and food insecurity observed when self-reported data are used may in fact represent a relationship between food insecurity and severe or morbid obesity.

Regardless of whether food insecurity was measured using 1 of the dimensions of food anxiety or compromised diet or the more extreme situation of food poverty, obesity prevalence rates were significantly higher among food-insecure individuals than among those who were food secure when self-reported data were used. When measured height and weight were used, most significant differences between food insecurity and obesity disappeared, but a more in-depth examination of the levels model reveals that female respondents who were food insecure with mild hunger were almost 3 times more likely to

TABLE 3—Logistic Regression Analysis of Obesity Associated With 3 Different Models of Food Insecurity Among Respondents Aged 12 Years or Older: CCHS 1.1, 2000–2001, and CCHS 2.2, 2004

	Adjusted Obesity Odds Ratio (95% Confidence Interval)	
	Self-Reported Height and Weight[a]	Measured Height and Weight[b]
Men		
Overall food insecurity model		
Yes	1.22* (1.20, 1.34)	1.23 (0.72, 2.07)
No (reference)	1.00	1.00
Dimensional food insecurity model, food anxiety		
Yes	1.03 (0.88, 1.22)	1.30 (0.78, 2.17)
No (reference)	1.00	1.00
Dimensional food insecurity model, compromised diet		
Yes	1.12 (0.97, 1.29)	0.92 (0.56, 1.52)
No (reference)	1.00	1.00
Dimensional food insecurity model, food poverty		
Yes	1.17 (0.96, 1.43)	0.89 (0.45, 1.74)
No (reference)	1.00	1.00
Levels of food insecurity model		1.02 (0.55, 1.88)
Insecurity without hunger	. . .	
Insecurity with mild hunger	. . .	1.77 (0.74, 4.27)
Insecurity with severe hunger	. . .	1.18 (0.31, 4.48)
Food security (reference)	. . .	1.00
Women		
Overall food insecurity model		
Yes	1.66* (1.53, 1.80)	1.35 (0.90, 2.00)
No (reference)	1.00	1.00
Dimensional food insecurity model, food anxiety		
Yes	1.10 (0.95, 1.28)	0.88 (0.52, 1.49)
No (reference)	1.00	1.00
Dimensional food insecurity model, compromised diet		
Yes	1.47* (1.31, 1.66)	1.35 (0.81, 2.23)
No (reference)	1.00	1.00
Dimensional food insecurity model, food poverty		
Yes	1.19* (1.02, 1.41)	1.38 (0.76, 2.52)
No (reference)	1.00	1.00
Levels of food insecurity model		
Insecurity without hunger	. . .	0.95 (0.60, 1.50)
Insecurity with mild hunger	. . .	2.72* (1.43, 5.16)
Insecurity with severe hunger	. . .	2.04 (0.74, 5.59)
Food security (reference)	. . .	1.00

Note. CCHS 1.1 = Canadian Community Health Survey, cycle 1.1; CCHS 2.2 = Canadian Community Health Survey, cycle 2.2. Each model was adjusted for age, household income, education, ethnicity, marital status, and place of residence. Missing categories for household income, education, ethnicity, and marital status were included in each model to maximize the sample size. See "Methods" section for information about how models were created. Obesity defined as a body mass index (weight in kilograms divided by height in meters squared) of 30 kg/m^2 or greater.

[a]In CCHS 1.1.

[b]In CCHS 2.2.

[d]Reference category.

*$P < .05$, for differences from total population.

be obese than were female respondents living in households without food insecurity. This demonstrates the intricate effects of food insecurity on food consumption patterns.

The reason that the outcome just described was significant only among women may be that women are more likely than men to be "emotional eaters," under stress, consuming increased amounts of sweet, fatty, and energy-dense foods.[32] Furthermore, the finding that mild stress may be associated with increased eating and severe stress with decreased consumption might explain why obesity is more prevalent among those in households at mild hunger levels.[13,17,33,34]

In contrast to the female respondents, the male respondents in food-secure households were no more likely than were male respondents in food-insecure households to be obese when measured height and weight were used. Moreover, obesity among male respondents was not associated with any dimension of food insecurity even when self-reported height and weight were used. This finding may support evidence showing that food insecurity is experienced differently by different members of a household.[35] Nutrient intake studies have shown that women may be the first to compromise their diet when the household is food insecure.[6,10] Also, research has shown that food insufficiency is associated with the consumption of fewer than 5 fruits or vegetables per day among women.[36]

As a household's concerns about food adequacy escalate, adjustments to food management take place, such as reduced quality of food purchased. One hypothesis suggests that decreased food purchasing power results in the purchasing of energy-dense foods and thus increased energy intakes.[37] If a woman is more likely to compromise her own nutrient intake for the sake of other household members, then she may become more vulnerable to consumption of energy-dense, nutrient-poor foods and hence obesity. Moreover, these consumption patterns may be transferred to other family members.[38] Child welfare laws may further contribute to women decreasing their food intake to ensure that their children's food intakes are adequate, given that insufficient diets among children may suggest parental neglect.[39]

Until further research is completed, associations between obesity and food insecurity should be cautiously interpreted. All of the instruments used to measure food security status have changed over time, and to date, they have neglected to describe frequencies and durations of food insecurity, which are both likely to influence BMIs.[40] Moreover, no tool has been validated to measure food security among Aboriginal populations in Canada.[41] Various types of geographical and cultural differences exist and should be recognized and considered in measurements of food security.

The present results substantiate the need for further research that would provide a better understanding of how health is influenced by the association between BMI and food insecurity. Our findings suggest that a more rigorous instrument needs to be developed to measure food insecurity in unison with measured height and weight. Furthermore, longitudinal studies incorporating consistent measures of food security would aid in delineating the association between obesity and food insecurity.[15,40] ■

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Contributors

A.-A. Lyons originated the study, J. Park was the primary statistician, and C.H. Nelson supervised all aspects of its implementation. All of the authors helped to conceptualize ideas, interpret findings, and write and review drafts of the article.

Human Participant Protection

No protocol approval was needed for this study.

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